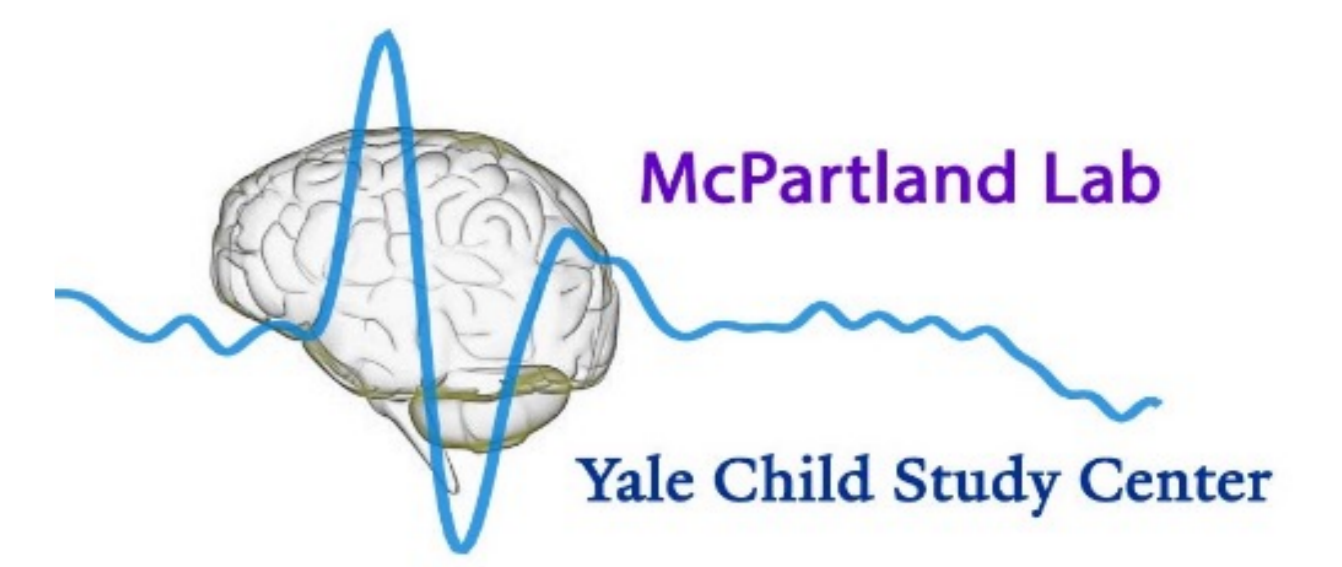


Influence of IQ, Adaptive Skills, and Internalizing/Externalizing Symptoms on Biomarker Data Acquisition in Children with Autism: Results from the Autism Biomarkers Consortium for Clinical Trials (ABC-CT)



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Background

- Autistic individuals experience higher rates of co-occurring conditions such as anxiety, depression, and ADHD.¹
- This co-occurrence can increase internalizing and externalizing symptoms, which have been linked to lower adaptive functioning in autistic children.^{2,3,4,5}
- Prior research indicates that IQ is a predictor of adaptive functioning, with lower IQ associated with reduced adaptive skills.^{5,6}
- There is limited understanding of how these conditions affect participation in lab-based biomarker research. Given similarities between the demands of research participation and educational or therapeutic environments, this work may provide relevant insight into adaptive functioning in other contexts.

Objectives

Investigate the relationship between clinical characteristics and successful acquisition of electroencephalogram (EEG) and eye-tracking (ET) biomarkers:

- Aim 1:** Examine IQ as a predictor of EEG/ET data acquisition
- Aim 2:** Examine internalizing and externalizing symptoms as predictors of EEG/ET data acquisition
- Aim 3:** Examine adaptive skills as a predictor of EEG/ET data acquisition

Methods

Participants

Autistic children ages 6-11 that participated in the Autism Biomarkers Consortium for Clinical Trials (ABC-CT).

- Only autistic participants with valid BASC, DAS-II, SRS-2 scores, and reported EEG and ET data acquisition were included in analyses.

Clinical Measures

- ASD diagnoses were confirmed with the Brief Observation of Symptoms of Autism (BOSA) and characterized for level of autism features with the Social Responsiveness Scale (SRS-2).
- FSIQ was measured using the Differential Ability Scales-II (DAS-II).
- Caregiver-reported behavior and emotion ratings were collected through the Behavior Assessment System for Children, Third Edition (BASC-3).
 - Externalizing and Internalizing Symptoms and Adaptive Skills T-Scores were used in analysis.

Table 1. Participant Demographics

N (Male)	Age	BOSA	FSIQ	SRS-2
143 (110)	8.52 (1.59) [6.02 - 11.56]	9.64 (2.65) [4 - 15]	101.2 (17.01) [61 - 147]	73.2 (10.11) [52 - 99]

*Note. M (SD) [Range] reported. Age reported in years. T-scores reported for SRS-2 ASD Severity.

Table 2. BASC-3 T-Scores

Externalizing Symptoms	60.57 (11.73) [38 - 92]
Internalizing Symptoms	56.6 (11.67) [34 - 88]
Adaptive Skills	36.98 (7.01) [18 - 58]

*Note. M (SD) [Range] reported.

EEG and ET Data Acquisition

- EEG acquisition success was measured as the proportion of experimenter coded, compliant trials attended per experimental paradigm (R (Resting), F (Faces), VEP (Visual Evoked Potential)).
- ET acquisition success was measured as the proportion of artifact-free trials per experimental paradigm (Activity Monitoring (AM), Pupillary Light Reflection (PLR), Social Interactive (SI), Static Scenes (SS)).

Statistical Analysis

- EEG and ET outcome variables were logit-transformed prior to analysis.
- For each aim, multivariate multiple regression analyses were conducted to assess the relationship between the predictors and EEG/ET data acquisition, controlling for age and ASD severity. Multivariate effects were evaluated using MANOVA, followed by univariate analyses.

Results

Across all models, age was a significant multivariate predictor of EEG and ET data acquisition ($F(7,133) = 3.84, p < .001$), whereas ASD severity was not ($p = .61$).

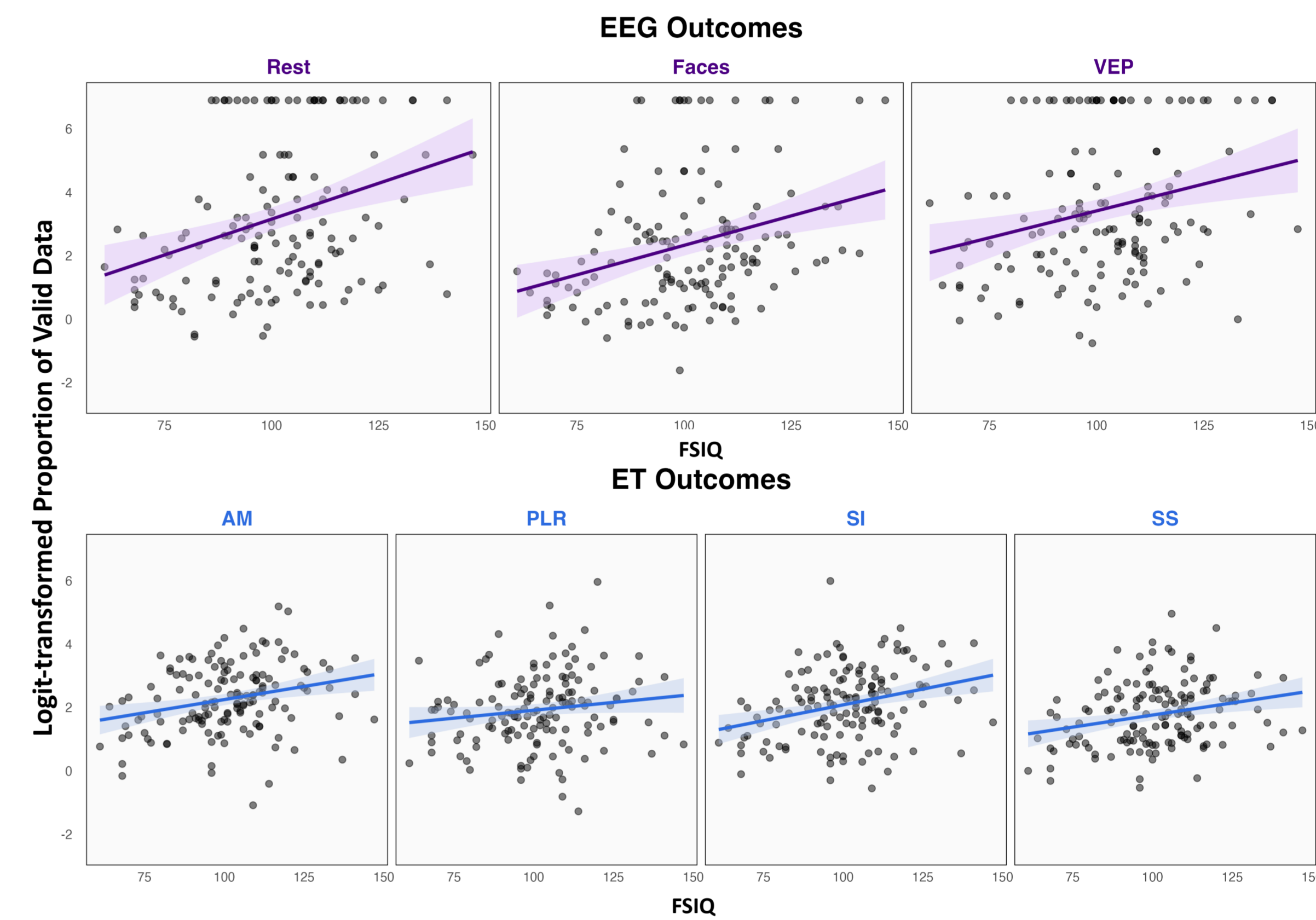
- Follow-up univariate analyses indicated that older age was associated with greater data acquisition across all EEG measures ($ps < .001$) and two ET measures (PLR: $p = .049$; SI: $p = .033$).

Aim 1: IQ as a predictor of EEG/ET Data Acquisition

Figure 1. Associations between Full-scale IQ and Data Acquisition across EEG and ET Paradigms

FSIQ significantly predicted EEG and ET data acquisition across experimental paradigms ($F(7,133) = 3.76, p < .001$).

- Follow-up univariate analyses showed that higher IQ was associated with greater EEG data acquisition (all $ps < .001$) and most eye-tracking measures (AM: $p = .002$; SI: $p < .001$; SS: $p = .003$; PLR: $p = .1$).



Aim 2: Internalizing and Externalizing Symptoms as predictors of EEG/ET Data Acquisition

Table 3. Univariate Associations between Internalizing and Externalizing Symptoms and EEG & ET Data Acquisition

Predictor	EEG Paradigms			ET Paradigms			
	Rest	Faces	VEP	AM	PLR	SI	SS
Internalizing	0.533	0.560	0.395	0.329	0.830	0.300	0.175
Externalizing	0.016	0.111	0.956	0.567	0.662	0.778	0.856

- Internalizing symptoms did not significantly predict EEG and ET data acquisition ($p = 0.66$).
- Externalizing symptoms showed a trend-level multivariate association with EEG and ET data acquisition ($F(7,132) = 1.73, p = .108$), with mixed directionality dependent on DV type.

Aim 3: Adaptive Skills as a predictor of EEG/ET Data Acquisition

Adaptive skills was a trend-level multivariate predictor of EEG and ET data acquisition ($F(7,133) = 1.93, p = .070$).

- Univariate analyses indicated that higher adaptive skills was associated with greater data acquisition across two EEG measures (R: $p = .009$; VEP: $.078$) and the social interactive ET measure ($p = .019$).

Conclusions

- IQ was a significant predictor of EEG and ET data acquisition across all experimental paradigms.
- Data acquisition was only partially related to age and externalizing symptoms (primarily in EEG paradigms) and was not related to Internalizing symptoms.
- Adaptive skills predicted data acquisition for two EEG measures and two ET measures.

Implications

- Our findings indicate a direct relationship between clinical measures (IQ and adaptive skills) and successful lab-based biomarker data acquisition in this population.
- The association between age and a subset of outcome biomarkers suggests that successful data acquisition is influenced by factors beyond chronological maturation alone.
- Current biomarker acquisition protocols may not adequately accommodate the physical and developmental needs of all autistic children, highlighting the need for more accessible and inclusive data collection approaches to ensure representative conclusions in autism research.

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